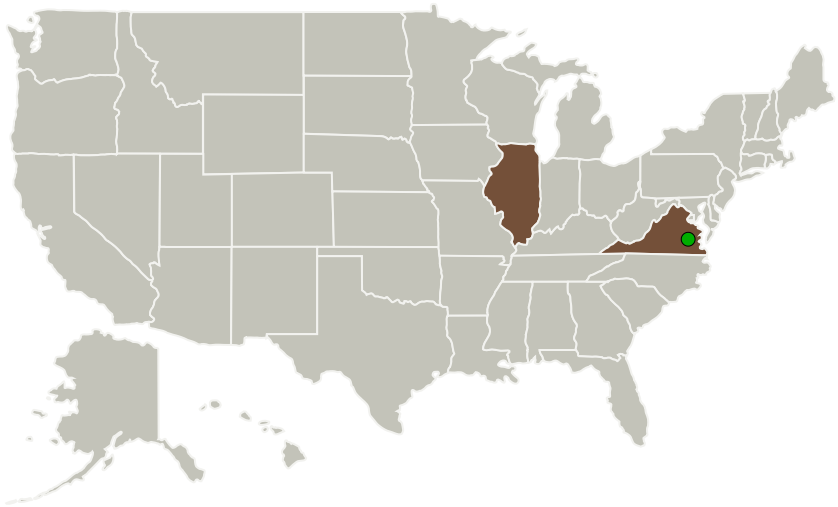
Reversible Adhesion Concept for In-Space Assembly, Phase I

Completed Technology Project (2017 - 2017)

Project Introduction

We will develop a conveniently reconfigurable joining approach to connect highly scalable multifunctional architectures with fiber-reinforced polymer composite links. A reversible solid-state bonding mechanism is enabled intrinsically by novel high-performance polymer resin, for which only physical contact and application of heat is required. The attachment scheme is amenable to automated robotic assembly along with minimized mass usage and power consumption. The ITR bonding is a fully reversible and solid-state process, which eliminates approaches that rely on uncured polymer or a meltable interstitial phase. Also, the ITR ensures physical integrity of joint members of the structure and the reversible adhesive within the range of temperatures experienced during day/night cycles in space. The reversible ITR bonding scheme is the first viable composite welding scheme for fully cured thermoset composites. In Phase I, we will demonstrate technical feasibility of the reversible solid-state ITR bonding approach on fully dense neat ATSP resin parts, carbon fiber reinforced ATSP resin composites (ATSP/C), and ATSP coated aerospace grade metal substrates through a wide spectrum of applications. Also, we will develop thermal-electrical-mechanical finite element analysis models for optimized composite design with tailorable physical properties. Additionally, we will design an electromechanically controlled automated induction heater integrated bonding toolkit device through further automated robotic assembly.

Primary U.S. Work Locations and Key Partners



Reversible adhesion concept for in-space assembly, Phase I Briefing Chart Image

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Organizations Performing Work	Role	Type	Location
ATSP Innovations	Lead Organization	Industry	Champaign, Illinois
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Illinois	Virginia

Images

Briefing Chart Image
Reversible adhesion concept for in-space assembly, Phase I Briefing Chart Image
(https://techport.nasa.gov/image/134628)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
ATSP Innovations

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

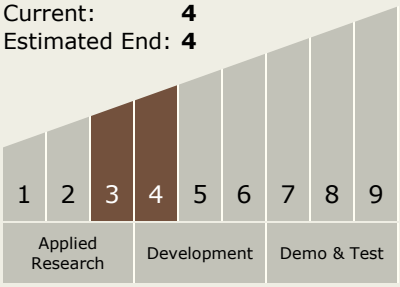
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Jacob Meyer

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.2 Mission Infrastructure, Sustainability, and Supportability
    - TX07.2.4 Micro-Gravity Construction and Assembly